FCC Part 15.407

TEST REPORT

For

Winmate Inc.

9F, No. 111-6, Shing-De Rd., San-Chung District, New Taipei City 241, Taiwan

FCC ID: PX9M700MT6625A

Report Type:	**Product Type:**
Original Report	Rugged Tablet PC

Report Producer:	Kaylee Chiang
Report Number:	RTWA170511001-00C
Report Date:	2017-09-13
Reviewed By:	Jerry Chang

Bay Area Compliance Laboratories Corp.(Taiwan)
70, Lane 169, Sec. 2, Datong Road,
Xizhi Dist., New Taipei City 22183, Taiwan, R.O.C.
Tel: +886 (2) 2647 6898
Fax: +886 (2) 2647 6895
www.bacl.com.tw

REVISION HISTORY

Revision	Issue Date	Description
1.0	2017.09.13	Original

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1 General Information

1.1 Product Description for Equipment Under Test (EUT)

Applicant:	Winmate Inc. 9F, No. 111-6, Shing-De Rd., San-Chung District, New Taipei City 241, Taiwan
Manufacturer:	Winmate Inc. 9F, No. 111-6, Shing-De Rd., San-Chung District, New Taipei City 241, Taiwan
Product:	Rugged Tablet PC
Main Model:	M700DM8
Series Model:	M700XXX (X=A~Z, a~z, 0~9 or blank)
Trade Name:	WINMATE
Frequency Range:	5180 MHz ~ 5240 MHz
Transmit Power:	IEEE 802.11a Mode: 15.47dBm
Modulation Technique:	IEEE 802.11a: OFDM
Transmit Data Rate:	IEEE 802.11a Mode :up to 54Mbps
Number of Channels:	IEEE 802.11a Mode: 4 Channels
Antenna Specification:	PIFA Antenna / Gain: 2 dBi
Voltage Range:	1) Adapter: I/P: 100-240Vac, 50/60Hz, 0.6A O/P: 5Vdc, 3.0A 2) Battery: 3.7Vdc
Date of Test:	Aug. 29, 2017 ~ Sep. 13, 2017

**All measurement and test data in this report was gathered from production sample serial number: 170511001 (Assigned by BACL, Taiwan) The EUT supplied by the applicant was received on 2017-05-11.*

Mode difference: The major electrical and mechanical constructions of series models are identical to the basic model, except different marketing purpose. The model, M700DM8 is the testing sample, and the final test data are shown on this test report.

1.2 Objective

This report is prepared on behalf of *Winmate Inc.* in accordance with FCC CFR47 §15.407.

The objective is to determine compliance with FCC Part 15.407 rules for Output Power, Antenna Requirements, AC Line Conducted Emissions, Emission Bandwidth, Power spectral density and Radiated Spurious Emissions.

1.3 Related Submittal(s)/Grant(s)

FCC Part 15, Subpart C, Equipment DTS with FCC ID: PX9M700MT6625A

1.4 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.10-2013, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz, and FCC KDB 789033 D02 General UNII Test Procedure New Rules v01r04.

1.5 Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Taiwan) to collect test data is located on
☒70, Lane 169, Sec. 2, Datong Road, Xizhi Dist., New Taipei City 22183, Taiwan, R.O.C.
☒68-3, Lane 169, Sec. 2, Datong Road, Xizhi Dist., New Taipei City 22183, Taiwan, R.O.C.

Bay Area Compliance Laboratories Corp. (Taiwan) Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code: 3180) and the FCC designation No. TW3180 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC Test. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.10.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 974454. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

2 System Test Configuration

2.1 Description of Test Configuration

The system was configured for testing in an engineering mode, which is provided by manufacture.
The system support 802.11a Mode

For 5150 ~ 5250MHz
4 channels are provided for 802.11a mode:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
36	5180	44	5220
40	5200	48	5240

For 802.11a, Channel 36, 40 and 48 was tested.

2.2 Equipment Modifications

No modification was made to the EUT

2.3 EUT Exercise Software

Used "SP_META" software.

UNII Band	Mode	Channel	Frequency (MHz)	Power setting
5150-5250MHz	802.11 a	Low	5180	19.5
		Middle	5200	19.5
		High	5240	19.5

The EUT was configured for testing in an engineering mode which was provided by the manufacturer.
The worst-case data rates are determined to be as follows for each mode based upon investigations by measuring the average power and PSD across all data rates bandwidths, and modulations.

802.11a: 6Mbps

2.4 Duty Cycle Correction Factor

According to KDB 789033 D02 General UNII Test Procedures New Rules v01r04 section B:

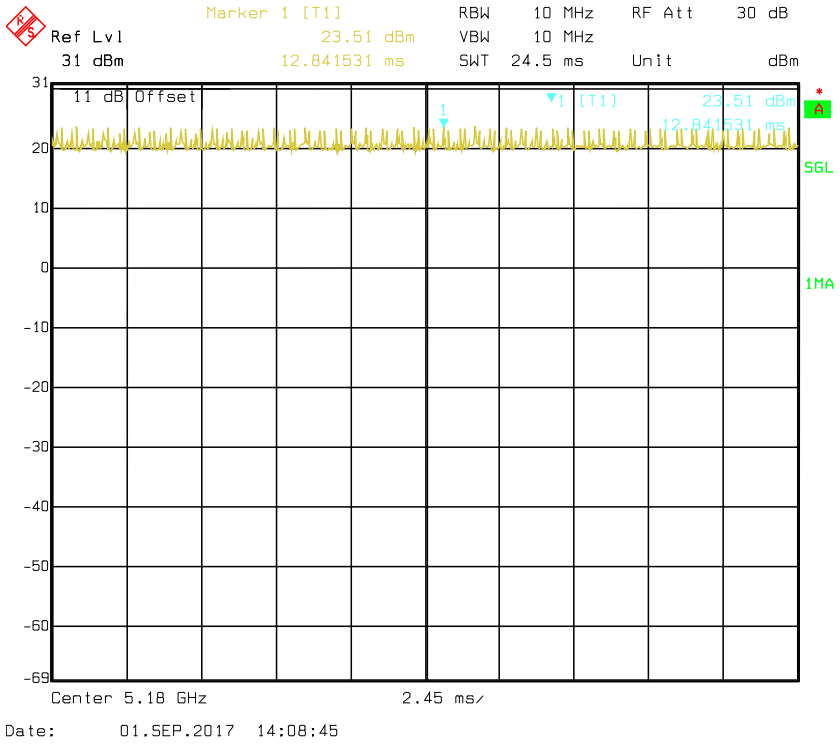
All measurements are to be performed with the EUT transmitting at 100% duty cycle at its maximum power control level; however, if 100% duty cycle cannot be achieved, measurements of duty cycle, x, and maximumpower transmission duration, T, are required for each tested mode of operation.

Radio Mode	On Time (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
802.11a	24.5	24.5	100	0

Note: Duty Cycle Correction Factor = 10*log(1/duty cycle)

Please refer to the following plots.

A Mode



2.5 Support Equipment List and Details

Description	Manufacturer	Model Number	BSMI	FCC ID	S/N
Tablet	Winmate	E430RM4	N/A	N/A	C160802-012-001-001

2.6 External Cable List and Details

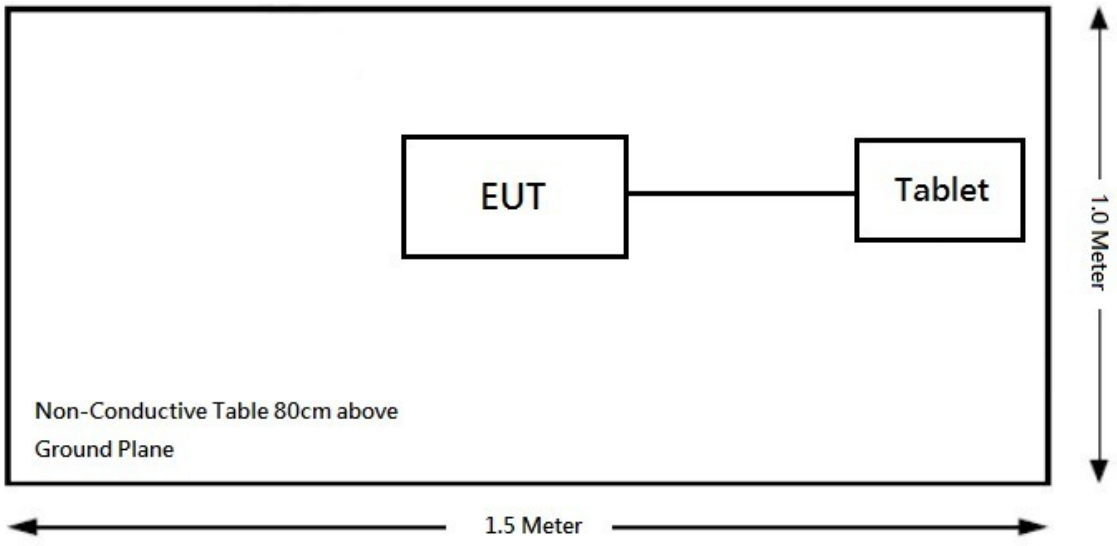
Cable Description	Length (m)	From	To
Micro USB Cable	1.5	NB	EUT

2.7 Block Diagram of Test Setup

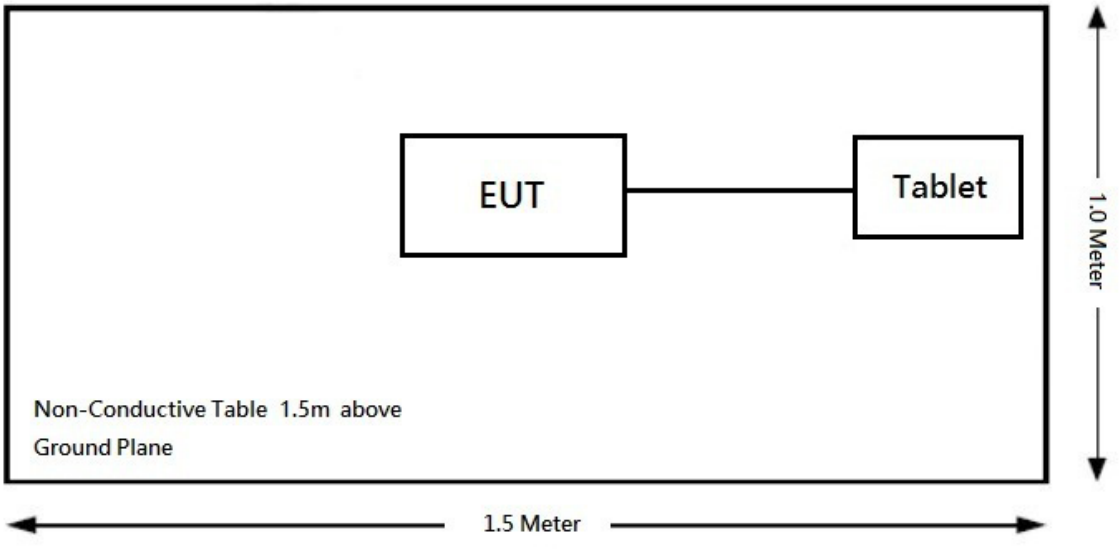
See test photographs attached in Exhibit A for the actual connections between EUT and support equipment.

Radiation:

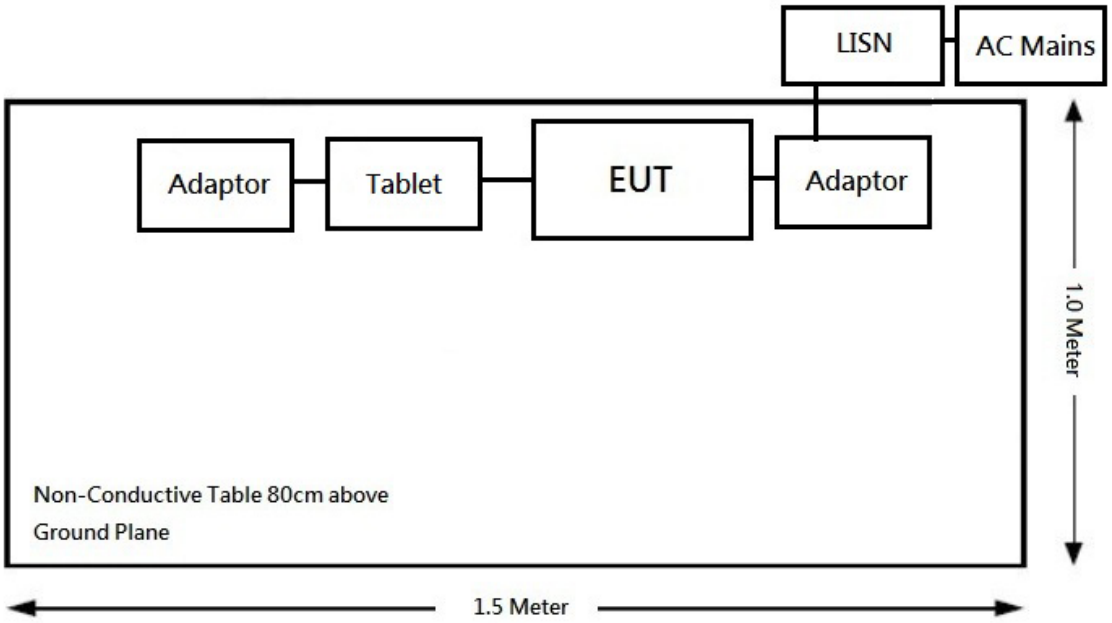
Below 1GHz:



Above 1GHz:



Conduction:


LISN
AC Mains
Adaptor
Tablet
EUT
Adaptor
1.0 Meter
Non-Conductive Table 80cm above
Ground Plane
1.5 Meter

3 Summary of Test Results

FCC Rules	Description of Test	Result
FCC §2.1093, §15.407(f),	RF Exposure	Compliance
FCC §15.203	Antenna Requirement	Compliance
FCC §15.207, §15.407(a) (6)	AC Power Line Conducted Emissions	Compliance
FCC §15.205, §15.209, 15.407(b)	Spurious Radiated Emissions	Compliance
FCC §15.407(a) (e)	Emission Bandwidth	Compliance
FCC §407(a)	Output Power	Compliance
FCC §15.407(a)	Power Spectral Density	Compliance

4 FCC §2.1093, §15.407(f) - RF EXPOSURE

4.1 Applicable Standard

According to§15.407(f) and §1.1310, U-NII devices are subject to the radio frequency radiation exposure requirements specified in §§ 1.1307(b) and 2.1093 of this chapter, as appropriate. All equipment shall be considered to operate in a "general population/uncontrolled" environment. Applications for equipment authorization of devices operating under this section must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions. Technical information showing the basis for this statement must be submitted to the Commission upon request

Systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to KDB 447498 D01 General RF Exposure Guidance v06
The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] ·
[√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where
1. f(GHz) is the RF channel transmit frequency in GHz.
2. Power and distance are rounded to the nearest mW and mm before calculation.
3. The result is rounded to one decimal place for comparison.
4. 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm, and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm according to 4.1 f) is applied to determine SAR test exclusion.

4.2 RF Exposure Evaluation Result

The SAR data please refer to the SAR report, report No.: RTWA170511001-23A.

5 FCC §15.203 – Antenna Requirements

5.1 Applicable Standard

According to § 15.203,

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited.

5.2 Antenna List and Details

No.	Manufacturer	Model	Antenna Type	Antenna Gain	Connector Type	Result
Ant 1	Winmate Inc.	M700DM8	PIFA Antenna	2 dBi	I-PEX	Compliance

The EUT have 1 external antenna for 5GHz Band, the antenna permanently attached to the unit.

6 FCC §15.207, §15.407(a) (6) - AC Power Line Conducted Emissions

6.1 Applicable Standard

As per FCC §15.407(a) (6)

Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207

As per FCC §15.207

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal.

The lower limit applies at the boundary between the frequencies ranges.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56 Note 1	56 to 46 Note 2
0.5-5	56	46
5-30	60	50

Note 1: Decreases with the logarithm of the frequency.
Note 2: A linear average detector is required

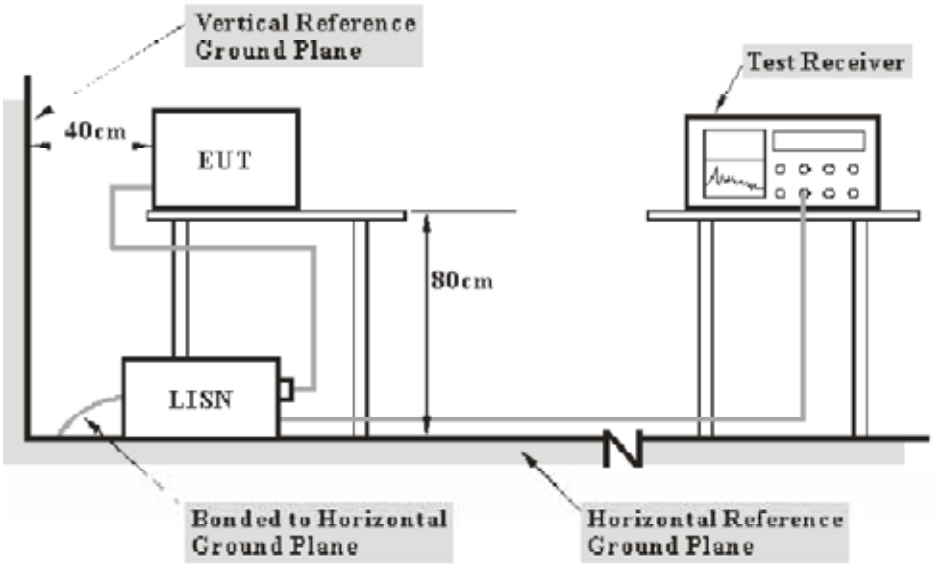
6.2 Measurement Uncertainty

Input quantities to be considered for conducted disturbance measurements maybe receiver reading, attenuation of the connection between LISN/ISN and receiver, LISN/ISN voltage division factor, LISN/ISN VDF frequency interpolation and receiver related input quantities, etc.

Based on CISPR 16-4-2:2011, the expended combined standard uncertainty of conducted disturbance test at Bay Area Compliance Laboratories Corp. (Taiwan) is shown as below. And the uncertainty will not be taken into consideration for the test data recorded in the report

Port	Expanded Measurement uncertainty
AC Mains	4.64 dB (k=2, 95% level of confidence)

6.3 EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

6.4 EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz. During the conducted emission test, the EMI test receiver was set with the following configurations

Frequency Range	RBW
150 kHz - 30 MHz	9 kHz

6.5 Test Procedure

During the conducted emission test, the adapter was connected to the outlet of the LISN. Maximizing procedure was performed on the six (6) highest emissions of the EUT. All data was recorded in the Quasi-peak and average detection mode.

6.6 Corrected Factor & Margin Calculation

The factor is calculated by adding LISN/ISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

Factor = LISN VDF + Cable Loss + Transient Limiter Attenuation

The "Over Limit" column of the following data tables indicates the degree of compliance with the applicable limit. For example, an over limit of -7 dB means the emission is 7 dB below the limit. The equation for Over Limit calculation is as follows:

Over Limit = Level – Limit Line

6.7 Test Equipment List and Details

Manufacturers	Descriptions	Models	Serial Numbers	Calibration Date	Calibration Due Date
LISN	Rohde & Schwarz	ENV216	101248	2017/07/20	2018/07/19
LISN	EMCO	3816/2	75848	2017/08/02	2018/08/01
EMI Test Receiver	Rohde & Schwarz	ESCI	100540	2016/11/03	2017/11/02
Pulse Limiter	Rohde & Schwarz	ESH3Z2	TXZEM025	2017/08/11	2018/08/10
RF Cable	EMEC	EM-CB5D	001	2017/07/24	2018/07/23
Software	AUDIX	E3	V9.150826k	N.C.R	N.C.R

**** Statement of Traceability:*** BACL Corp. attests that all calibrations have been performed according to TAF requirements, traceable to the ETC.

6.8 Test Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	58 %
ATM Pressure:	1020 hPa

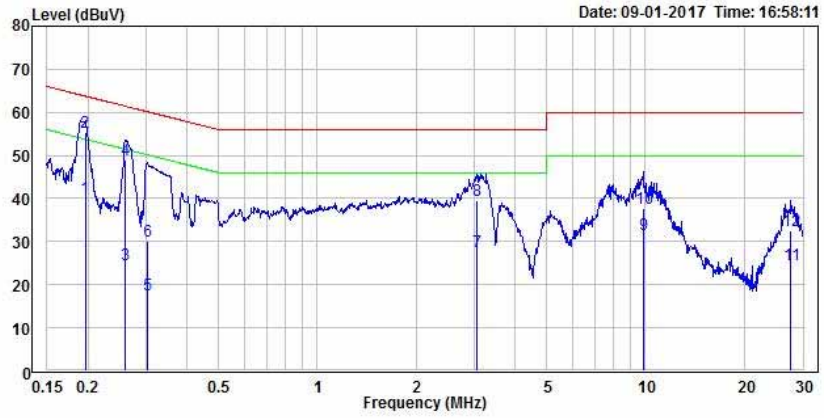
The testing was performed by Andy Shih on 2017-09-01.

6.9 Test Results

Test Mode: Transmitting

Please refer to the following plots and tables.

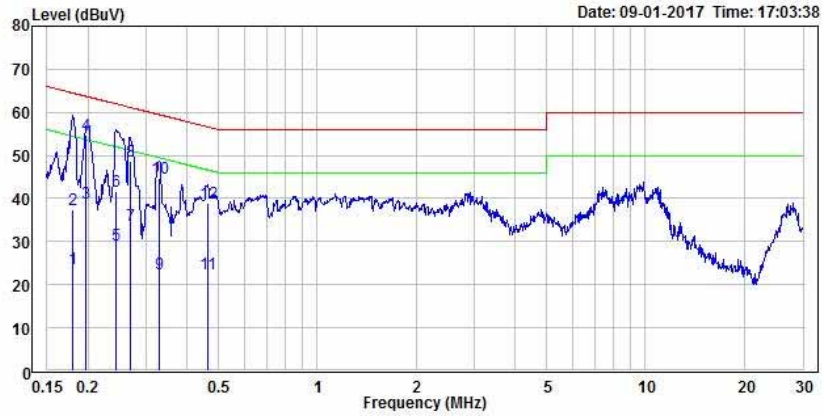
Main: AC 120V/60 Hz, Line



Condition: Line
EUT :
Mode :
Note :

	Freq	Level	Limit Line	Over Limit	Factor	Read Level	Remark	Pol/Phase
	MHz	dBuV	dBuV	dB	dB	dBuV		
1	0.196	40.24	63.78	-23.54	19.50	20.74	Average	Line
2	0.196	55.32	63.78	-8.46	19.50	35.82	QP	Line
3	0.260	24.72	61.42	-36.70	19.50	5.22	Average	Line
4	0.260	48.99	61.42	-12.43	19.50	29.49	QP	Line
5	0.303	17.71	60.16	-42.45	19.50	-1.79	Average	Line
6	0.303	29.96	60.16	-30.20	19.50	10.46	QP	Line
7	3.069	27.69	56.00	-28.31	19.63	8.06	Average	Line
8	3.069	39.40	56.00	-16.60	19.63	19.77	QP	Line
9	9.887	31.56	60.00	-28.44	19.77	11.79	Average	Line
10	9.887	37.65	60.00	-22.35	19.77	17.88	QP	Line
11	27.587	24.69	60.00	-35.31	19.87	4.82	Average	Line
12	27.587	32.66	60.00	-27.34	19.87	12.79	QP	Line

Main: AC 120V/60 Hz, Neutral



Condition: Neutral
EUT :
Mode :
Note :

	Freq	Level	Limit Line	Over Limit	Factor	Read Level	Remark	Pol/Phase
	MHz	dBuV	dBuV	dB	dB	dBuV		
1	0.180	23.59	64.51	-40.92	19.63	3.96	Average	Neutral
2	0.180	37.53	64.51	-26.98	19.63	17.90	QP	Neutral
3	0.198	38.88	63.71	-24.83	19.63	19.25	Average	Neutral
4	0.198	54.69	63.71	-9.02	19.63	35.06	QP	Neutral
5	0.243	29.31	61.99	-32.68	19.63	9.68	Average	Neutral
6	0.243	41.57	61.99	-20.42	19.63	21.94	QP	Neutral
7	0.269	33.69	61.16	-27.47	19.63	14.06	Average	Neutral
8	0.269	48.63	61.16	-12.53	19.63	29.00	QP	Neutral
9	0.331	22.39	59.43	-37.04	19.64	2.75	Average	Neutral
10	0.331	44.77	59.43	-14.66	19.64	25.13	QP	Neutral
11	0.462	22.47	56.65	-34.18	19.64	2.83	Average	Neutral
12	0.462	38.95	56.65	-17.70	19.64	19.31	QP	Neutral

7 FCC §15.209, §15.407(b) – Spurious Radiated Emission

7.1 Applicable Standard

As Per FCC §15.205(a) and RSS-Gen except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110 0.495 – 0.505 2.1735 – 2.1905 4.125 – 4.128 4.17725 – 4.17775 4.20725 – 4.20775 6.215 – 6.218 6.26775 – 6.26825 6.31175 – 6.31225 8.291 – 8.294 8.362 – 8.366 8.37625 – 8.38675 8.41425 – 8.41475 12.29 – 12.293 12.51975 – 12.52025 12.57675 – 12.57725 13.36 – 13.41	16.42 – 16.423 16.69475 – 16.69525 25.5 – 25.67 37.5 – 38.25 73 – 74.6 74.8 – 75.2 108 – 121.94 123 – 138 149.9 – 150.05 156.52475 – 156.52525 156.7 – 156.9 162.0125 –167.17 167.72 – 173.2 240 – 285 322 – 335.4 399.9 – 410 608 – 614	960 – 1240 1300 – 1427 1435 – 1626.5 1645.5 – 1646.5 1660 – 1710 1718.8 – 1722.2 2200 – 2300 2310 – 2390 2483.5 – 2500 2690 – 2900 3260 – 3267 3.332 – 3.339 3 3458 – 3 358 3.600 – 4.400	4. 5 – 5. 15 5. 35 – 5. 46 7.25 – 7.75 8.025 – 8.5 9.0 – 9.2 9.3 – 9.5 10.6 – 12.7 13.25 – 13.4 14.47 – 14.5 15.35 – 16.2 17.7 – 21.4 22.01 – 23.12 23.6 – 24.0 31.2 – 31.8 36.43 – 36.5 Above 38.6

As per FCC §15.209: The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100 Note 1	3
88 - 216	150 Note 1	3
216 - 960	200 Note 1	3
Above 960	500	3

Note 1: Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

As per FCC Part 15.407 (b)

(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(2) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

(3) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207.

(4) The provisions of §15.205 apply to intentional radiators operating under this section.

7.2 Measurement Uncertainty

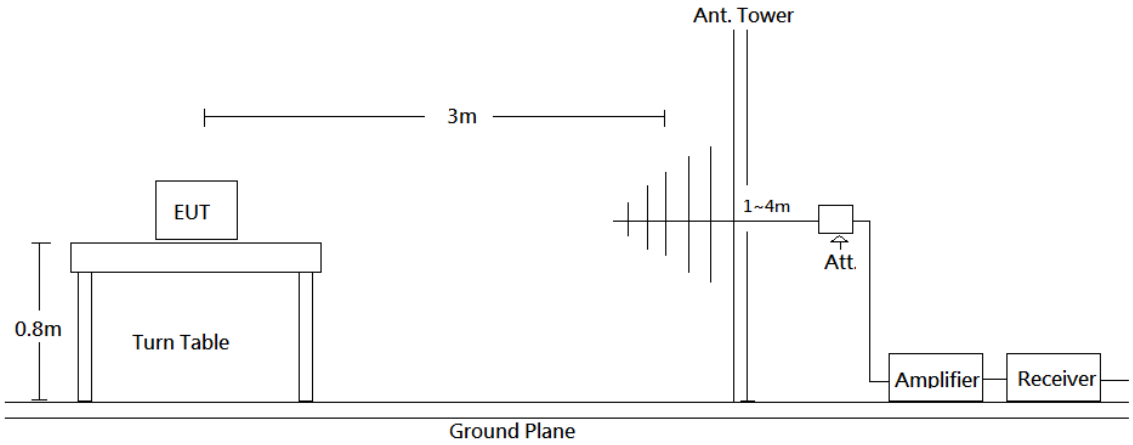
All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on CISPR 16-4-2:2011, the expended combined standard uncertainty of radiation emissions at Bay Area Compliance Laboratories Corp. (Taiwan) is shown in below table. And the uncertainty will not be taken into consideration for the test data recorded in the report.

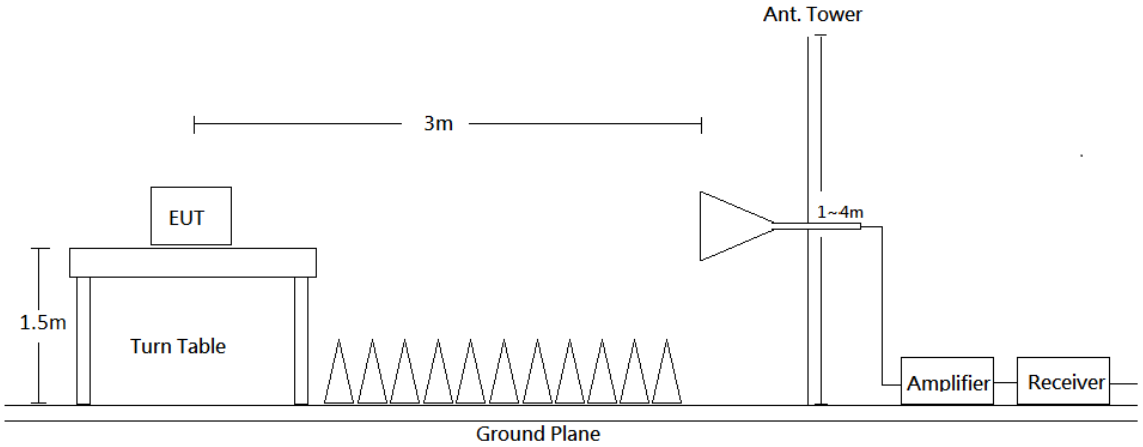
Frequency	Measurement uncertainty
30 MHz~200 MHz	3.76 dB (k=2, 95% level of confidence)
200 MHz~1 GHz	4.12 dB (k=2, 95% level of confidence)
1 GHz~6 GHz	4.84 dB (k=2, 95% level of confidence)
6 GHz~18 GHz	5.16 dB (k=2, 95% level of confidence)
18 GHz~26 GHz	4.84 dB (k=2, 95% level of confidence)
26 GHz~40 GHz	4.30 dB (k=2, 95% level of confidence)

7.3 EUT Setup

Blow 1 GHz:



Above 1 GHz:



Radiated emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC Part 15.209 and FCC 15.407 Limits.

7.4 EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 40 GHz. During the radiated emission test, the EMI test receiver for below 1GHz and spectrum analyzer for above 1GHz was set with the following configurations measurement method 6.3 in ANSI C63.10.

Frequency Range	RBW	VBW	Detector	Duty cycle	Measurement method
30-1000 MHz	120 kHz	300 kHz	QP		QP
Above 1 GHz	1 MHz	3 MHz	PK		PK
	1 MHz	3 MHz	RMS	>98%	Ave
	1 MHz	1/T	PK	<98%	Ave

7.5 Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

All data was recorded in the Quasi-peak detector mode from 30 MHz to 1 GHz and PK and average detector modes for frequencies above 1 GHz.

According to C63.10-2013, emission shall be computed as: E [dBμV/m] = EIRP[dBm] + 95.2, for d = 3 meters.

Frequency Band 5150~5250 MHz EIRP Limit -27(dBm/MHz) Equivalent Field Strength at 3m is 68.23 dBμV/m

7.6 Corrected Factor & Margin Calculation

The Correct Factor is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain + Attenuator

The “Margin” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

Margin = Result –Limit

7.7 Test Results Summary

According to the data in the following table, the EUT complied with the FCC §15.209 Limit. Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$$Lm + U(Lm) \leq Llim + Ucispr$$

In BACL, U(Lm) is less than Ucispr, if Lm is less than Llim, it implies that the EUT complies with the limit.

7.8 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
Broadband Antenna	Sunol Sciences	JB6	A050115	2016/11/16	2017/11/15
Amplifier	Sonoma	310N	130602	2017/07/03	2018/07/02
EMI Test Receiver	Rohde & Schwarz	ESR7	101419	2016/11/03	2017/11/02
Mircoflex Cable	UTIFLEX	UFB311A-Q-1440-300300	220490-006	2016/11/02	2017/11/01
Mircoflex Cable	UTIFLEX	UFB197C-1-2362-70U-70U	225757-001	2017/07/13	2018/07/12
Mircoflex Cable	UTIFLEX	UFA210A-1-3149-300300	MFR64639 226389-001	2016/11/29	2017/11/28
Turn Table	Champro	TT-2000	060772-T	N.C.R	N.C.R
Antenna Tower	Champro	AM-BS-4500-B	060772-A	N.C.R	N.C.R
Controller	Champro	EM1000	060772	N.C.R	N.C.R
Software	Farad	EZ_EMC	BACL-03A1	N.C.R	N.C.R
Broadband Antenna	Sunol Sciences	JB6	A050115	2016/11/16	2017/11/15
Horn Antenna	EMCO	3115	9311-4158	2017/05/31	2018/05/30
Horn Antenna	ETS-Lindgren	3116	00062638	2016/09/04	2017/09/03
Preamplifier	EMEC	EM01G18G	060657	2016/12/13	2017/12/12
Preamplifier	EMEC	EM18G40G	060656	2016/12/13	2017/12/12
Spectrum Analyzer	Rohde & Schwarz	FSV40	101203	2017/07/13	2018/07/12
Mircoflex Cable	ROSNAL	K1K50-UP0264-K1K50-80CM	160309-2	2017/01/18	2018/01/17
Mircoflex Cable	ROSNAL	K1K50-UP0264-K1K50-450CM	160309-1	2017/03/24	2018/03/23

**** Statement of Traceability:*** BACL Corp. attests that all calibrations have been performed according to TAF requirements, traceable to the ETC.

7.9 Test Environmental Conditions

Temperature:	24 ° C
Relative Humidity:	57 %
ATM Pressure:	1020 hPa

The testing was performed by Andy Shih on 2017-08-29.

7.10 Test Results

30MHz ~ 40GHz:

Mode: Transmitting Mode (Pre-scan with three orthogonal axis, and worse case as X axis).

802.11a

Horizontal

Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
5180 MHz								
151.2500	46.95	-11.22	35.73	43.50	-7.77	100	254	QP
191.9900	47.29	-12.35	34.94	43.50	-8.56	100	281	QP
480.0800	43.97	-6.05	37.92	46.00	-8.08	100	118	QP
604.2400	40.53	-3.92	36.61	46.00	-9.39	100	227	QP
696.3900	37.00	-2.87	34.13	46.00	-11.87	100	196	QP
960.2300	33.30	2.92	36.22	54.00	-17.78	100	134	QP
5150.000	66.60	1.89	68.49	74.00	-5.51	100	330	peak
5150.000	50.59	1.89	52.48	54.00	-1.52	100	330	AVG
5180.000	103.30	1.95	105.25	N/A	N/A	100	156	peak
5180.000	96.21	1.95	98.16	N/A	N/A	100	156	AVG
10360.000	36.37	12.40	48.77	68.23	-19.46	100	91	peak
5200 MHz								
119.2400	41.05	-10.89	30.16	43.50	-13.34	100	254	QP
191.9900	49.45	-12.35	37.10	43.50	-6.40	100	285	QP
312.2700	42.86	-9.58	33.28	46.00	-12.72	100	276	QP
455.8300	42.99	-6.44	36.55	46.00	-9.45	100	117	QP
672.1400	32.26	-3.12	29.14	46.00	-16.86	100	254	QP
800.1800	32.44	-0.57	31.87	46.00	-14.13	100	278	QP
5200.000	104.66	1.97	106.63	N/A	N/A	100	123	peak
5200.000	94.97	1.97	96.94	N/A	N/A	100	123	AVG
10400.000	37.15	12.43	49.58	68.23	-18.65	100	339	peak
5240 MHz								
95.9600	44.18	-15.57	28.61	43.50	-14.89	100	221	QP
312.2700	42.82	-9.58	33.24	46.00	-12.76	100	270	QP
529.5500	38.77	-5.29	33.48	46.00	-12.52	100	258	QP
576.1100	31.13	-4.46	26.67	46.00	-19.33	100	264	QP
800.1800	34.56	-0.57	33.99	46.00	-12.01	100	201	QP
906.8800	30.98	1.57	32.55	46.00	-13.45	100	58	QP
5240.000	104.77	2.03	106.80	N/A	N/A	114	124	peak
5240.000	94.95	2.03	96.98	N/A	N/A	114	124	AVG
5350.000	52.59	2.21	54.80	74.00	-19.20	125	354	peak
5350.000	43.76	2.21	45.97	54.00	-8.03	125	354	AVG
10480.000	34.33	12.49	46.82	68.23	-21.41	100	296	peak

Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Spurious emissions more than 20 dB below the limit were not reported.

Vertical

Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
5180 MHz								
215.2700	50.03	-12.86	37.17	43.50	-6.33	100	233	QP
408.3000	37.42	-7.53	29.89	46.00	-16.11	100	360	QP
527.6100	41.29	-5.32	35.97	46.00	-10.03	100	319	QP
672.1400	33.12	-3.12	30.00	46.00	-16.00	100	356	QP
800.1800	30.48	-0.57	29.91	46.00	-16.09	100	263	QP
919.4900	27.34	1.89	29.23	46.00	-16.77	100	287	QP
5150.000	63.95	1.89	65.84	74.00	-8.16	153	230	peak
5150.000	48.44	1.89	50.33	54.00	-3.67	153	230	AVG
5180.000	104.76	1.95	106.71	N/A	N/A	145	233	peak
5180.000	94.72	1.95	96.67	N/A	N/A	145	233	AVG
10360.000	36.78	12.40	49.18	68.23	-19.05	100	256	peak
5200 MHz								
34.8500	40.69	-6.93	33.76	40.00	-6.24	100	215	QP
151.2500	45.46	-11.22	34.24	43.50	-9.26	100	249	QP
527.6100	40.20	-5.32	34.88	46.00	-11.12	100	331	QP
672.1400	32.23	-3.12	29.11	46.00	-16.89	100	347	QP
800.1800	30.68	-0.57	30.11	46.00	-15.89	100	227	QP
864.2000	28.34	0.69	29.03	46.00	-16.97	100	288	QP
5200.000	105.30	1.97	107.27	N/A	N/A	190	228	peak
5200.000	95.86	1.97	97.83	N/A	N/A	190	228	AVG
10400.000	38.20	12.43	50.63	68.23	-17.60	200	174	peak
5240 MHz								
151.2500	45.22	-11.22	34.00	43.50	-9.50	100	245	QP
251.1600	46.34	-11.99	34.35	46.00	-11.65	100	185	QP
408.3000	38.20	-7.53	30.67	46.00	-15.33	100	1	QP
527.6100	40.37	-5.32	35.05	46.00	-10.95	100	329	QP
672.1400	32.99	-3.12	29.87	46.00	-16.13	100	2	QP
800.1800	40.07	-0.57	39.50	46.00	-6.50	100	350	QP
5240.000	104.95	2.03	106.98	N/A	N/A	195	226	peak
5240.000	95.41	2.03	97.44	N/A	N/A	195	226	AVG
5350.000	52.15	2.21	54.36	74.00	-19.64	140	122	peak
5350.000	43.95	2.21	46.16	54.00	-7.84	140	122	AVG
10480.000	35.73	12.49	48.22	68.23	-20.01	100	214	peak

Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Spurious emissions more than 20 dB below the limit were not reported.

8 FCC §15.407(e) –Emission Bandwidth

8.1 Applicable Standard

As per FCC §15.407(a): Measurements in the 5.15-5.25 GHz, 5.25-5.35 GHz, and the 5.47-5.725 GHz bands are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A narrower resolution bandwidth can be used, provided that the measured power is integrated over the full reference bandwidth.

8.2 Measurement Procedure

As per KDB 789033 D02 General UNII Test Procedures New Rules v01r04

Emission Bandwidth (EBW)

a) Set RBW = approximately 1% of the emission bandwidth.

b) Set the VBW > RBW.

c) Detector = Peak.

d) Trace mode = max hold.

e) Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

99% Occupied Bandwidth

The 99% occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5 % of the total mean power of the given emission. Measurement of the 99% occupied bandwidth is *required* only as a condition for using the optional band-edge measurement techniques described in II.G.3.d). Measurements of 99% occupied bandwidth may also optionally be used in lieu of the EBW to define the minimum frequency range over which the spectrum is integrated when measuring maximum conducted output power as described in II.E. However, the EBW must be measured to determine bandwidth dependent limits on maximum conducted output power in accordance with 15.407(a).
The following procedure shall be used for measuring (99 %) power bandwidth:

1. Set center frequency to the nominal EUT channel center frequency.

2. Set span = 1.5 times to 5.0 times the OBW.

3. Set RBW = 1 % to 5 % of the OBW

4. Set VBW ≥ 3 · RBW

5. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.

6. Use the 99 % power bandwidth function of the instrument (if available).

7. If the instrument does not have a 99 % power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

8.3 Test Equipment List and Details

Descriptions	Manufacturers	Models	Serial Numbers	Calibration Date	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	FSEK30	825084/006	2016/12/15	2017/12/14
Attenuator	MINI-CIRCUITS	BW-S10W5+	N/A	2017/03/16	2018/03/15
Cable	WOKEN	SFL402	S02-160323-07	2017/02/22	2018/02/21

**** Statement of Traceability:*** BACL Corp. attests that all calibrations have been performed according to TAF requirements, traceable to the ETC.

8.4 Test Environmental Conditions

Temperature:	26° C
Relative Humidity:	58 %
ATM Pressure:	1010 hPa

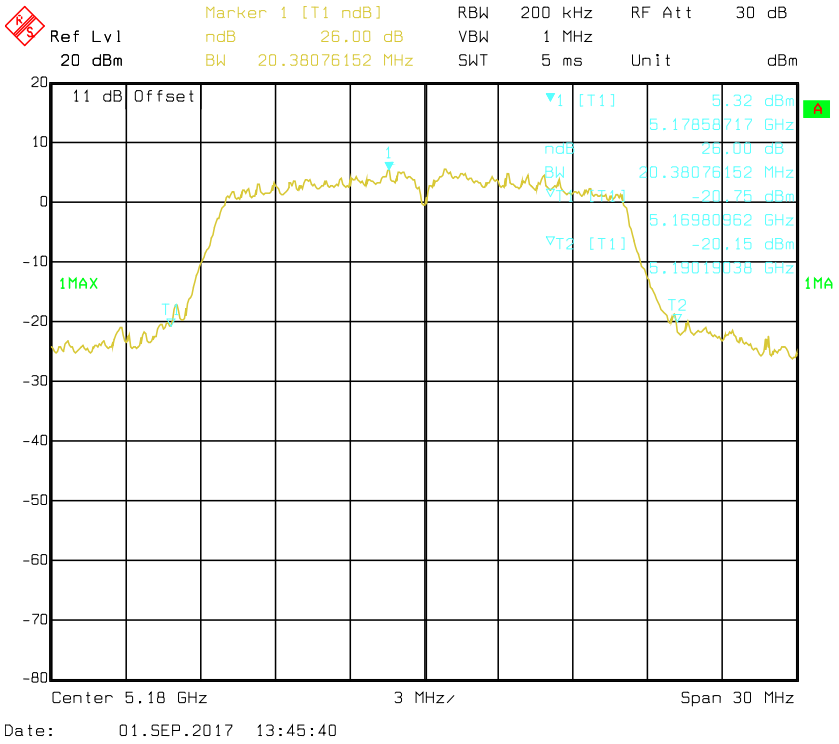
The testing was performed by Andy Shih on 2017-09-01.

8.5 Test Results

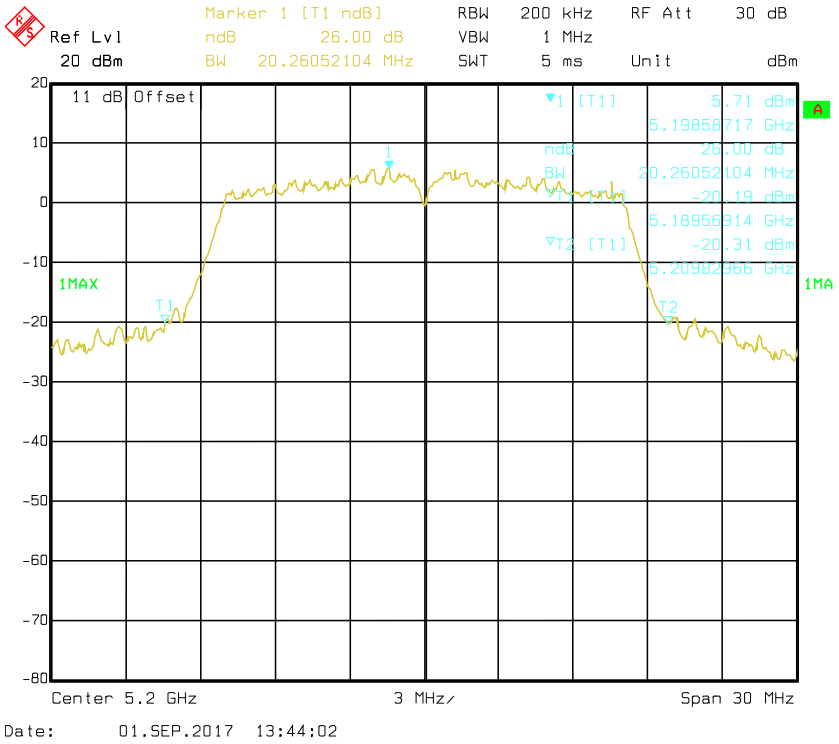
Channel	Frequency (MHz)	26 dB Emission Bandwidth (MHz)	99% Bandwidth (MHz)	Remark
802.11a Mode				
Low	5180	20.38	16.77	No transmitted signal in the 99% bandwidth extends into the U-NII-2A band
Mid	5200	20.26	16.71	
High	5240	20.32	16.71	

26 dB Emission Bandwidth

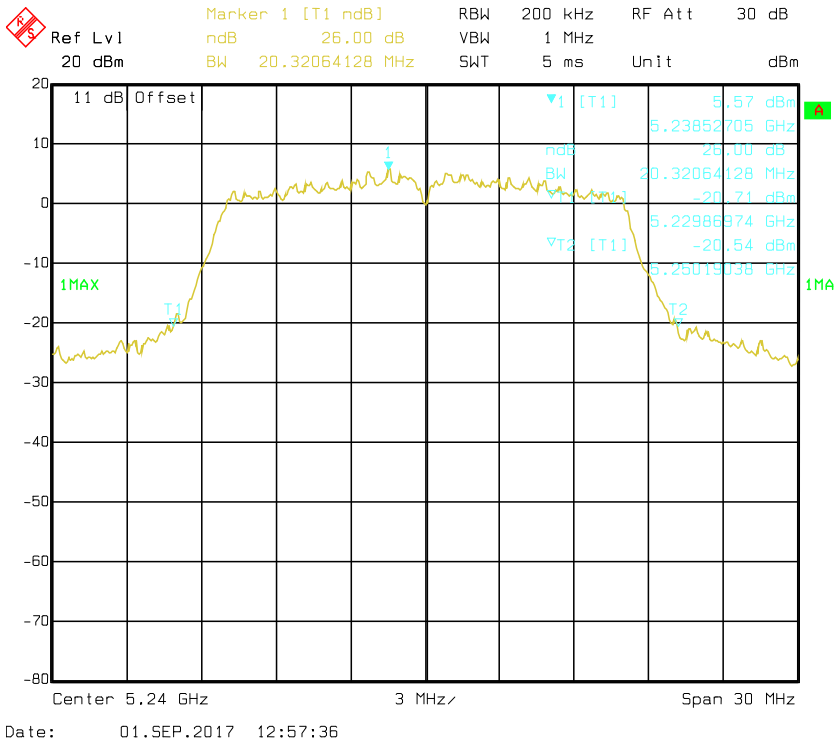
Low Channel



Middle Channel

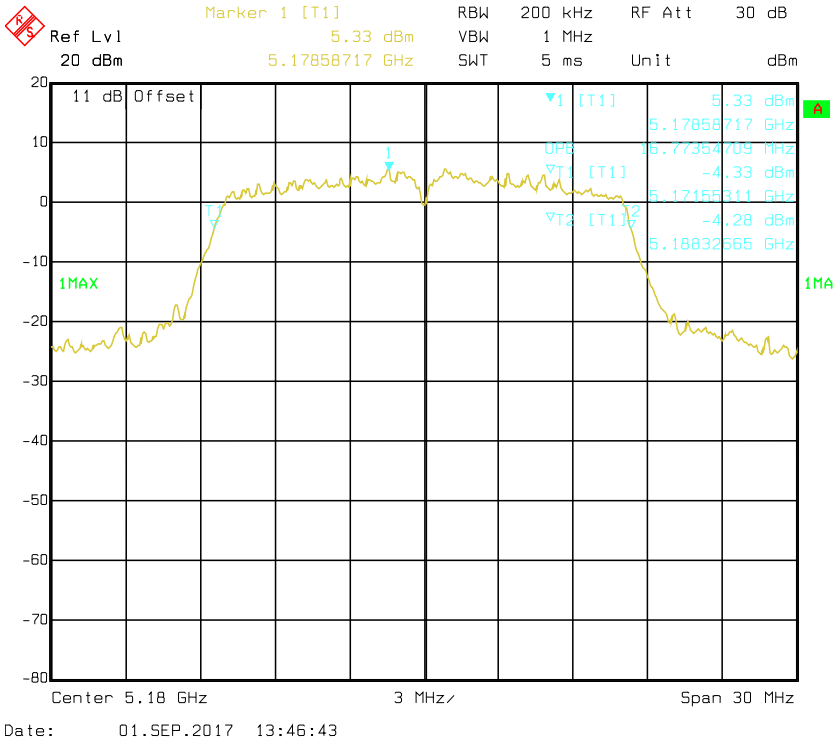


High Channel

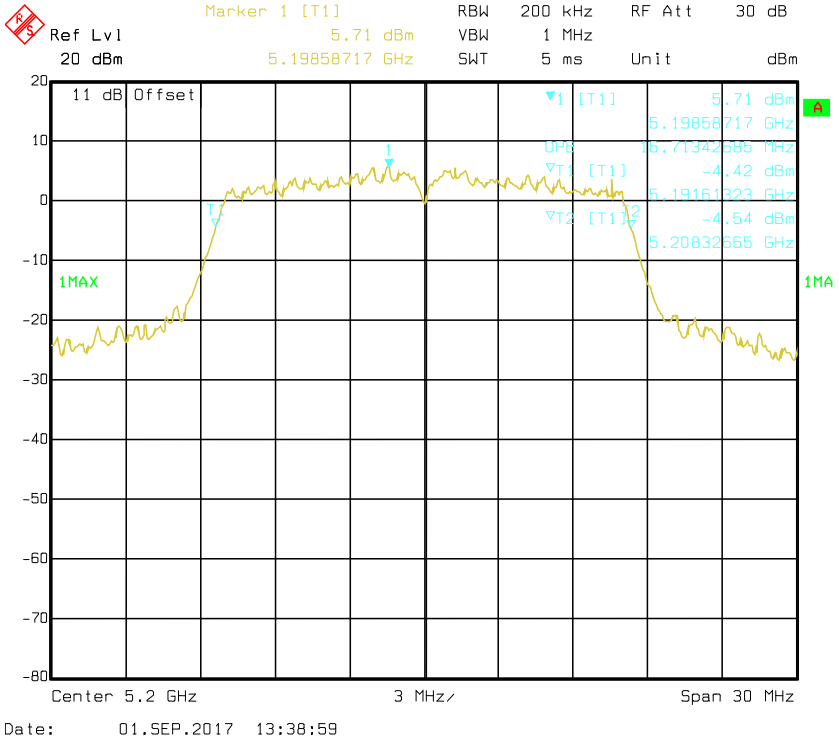


99% Bandwidth

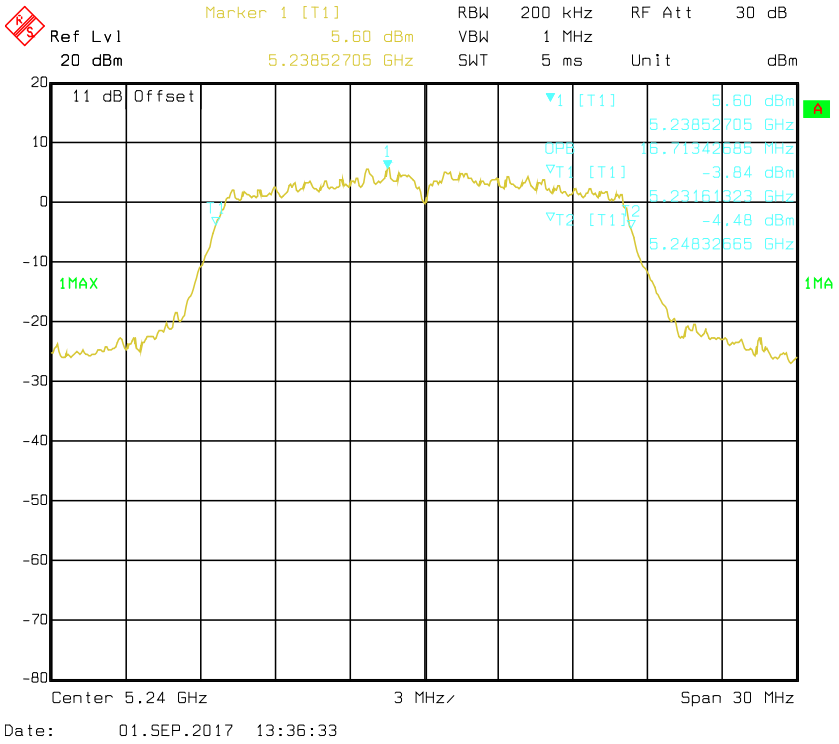
Low Channel



Middle Channel



High Channel



9 FCC §15.407(a) – Output Power

9.1 Applicable Standard

According to FCC §15.407(a):

For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

9.2 Test Procedure

According to KDB 789033 D02 General UNII Test Procedures New Rules v01r04
The use Power Meter

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to a measuring equipment.

9.3 Test Equipment List and Details

Descriptions	Manufacturers	Models	Serial Numbers	Calibration Date	Calibration Due Date
Power Sensor	KEYSIGHT	U2021XA	MY54080018	2017/03/21	2018/03/20
Attenuator	MINI-CIRCUITS	BW-S10W5+	N/A	2017/03/16	2018/03/15
Cable	WOKEN	SFL402	S02-160323-07	2017/02/22	2018/02/21

**** Statement of Traceability:*** BACL Corp. attests that all calibrations have been performed according to TAF requirements, traceable to the ETC.

9.4 Test Environmental Conditions

Temperature:	26° C
Relative Humidity:	58 %
ATM Pressure:	1010 hPa

The testing was performed by Andy Shih on 2017-09-01.

9.5 Test Results

Channel	Frequency (MHz)	Conducted Average Output Power (dBm)	Duty factor (dB)	Total Conducted Average Output Power (dBm)	Limit (dBm)	Result
802.11 a Mode						
Low	5180	15.39	0	15.39	24	PASS
Mid	5200	15.44	0	15.44	24	PASS
High	5240	15.47	0	15.47	24	PASS

10 FCC §15.407(g) – FREQUENCY STABILITY

10.1 Applicable Standard

FCC §15.407(g)

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual.

10.2 Test Procedure

According to ANSI C63.10-2013 §6.8
Some unlicensed wireless device requirements specify frequency stability tests with variation of supply voltage and temperature; the requirements can be found in the regulatory specifications for each type of unlicensed wireless device. The procedures listed in 6.8.1 and 6.8.2 shall be used for frequency stability tests.

10.3 Test Equipment List and Details

Descriptions	Manufacturers	Models	Serial Numbers	Calibration Date	Calibration Due Date
Temp & midity Chamber	BACL	BTH-150	30028	2016/12/09	2017/12/08
Spectrum Analyzer	Rohde & Schwarz	FSEK30	825084/006	2016/12/15	2017/12/14
Attenuator	MINI-CIRCUITS	BW-S10W5+	N/A	2017/03/16	2018/03/15
Digital Multimeter	Fluke	114	TXZSF018	2017/02/10	2018/02/09
Cable	WOKEN	SFL402	S02-160323-07	2017/02/22	2018/02/21
Power Supply	KIKUSUI	PM35-2	MK002127	N.C.R	N.C.R

**** Statement of Traceability:*** BACL Corp. attests that all calibrations have been performed according to TAF requirements, traceable to the ETC.

10.4 Test Environmental Conditions

Temperature:	25° C
Relative Humidity:	56 %
ATM Pressure:	1010 hPa

The testing was performed by Andy Shih on 2017-09-13.

10.5 Test Results

5150-5250MHz

802.11a Mode:

Temperature	Voltage	f_L at Low Test Channel	f_H at High Test Channel	Limit
(℃)	(Vdc)	MHz	MHz	
0	3.7	5171.55311	5248.32665	f_L and f_H within 5150~5250MHz
10		5171.55323	5248.32676	
20		5171.55317	5248.32654	
30		5171.55316	5248.32649	
40		5171.55321	5248.32666	
25	3.5	5171.55319	5248.32669	
	4.2	5171.55325	5248.32654	

11 FCC §15.407(a) – Power Spectral Density

11.1 Applicable Standard

According to FCC §15.407(a):

For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

11.2 Test Procedure

According to KDB 789033 D02 General UNII Test Procedures New Rules v01r04

For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in Section 15.407(a)(5). For devices operating in the band 5.725-5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500 kHz, "provided that the measured power is integrated over the full reference bandwidth" to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 kHz bandwidth, the following adjustments to the procedures apply:
a) Set RBW ≥ 1/*T*, where *T* is defined in II.B.l.a).

b) Set VBW ≥ 3 RBW.

c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10 log (500 kHz/RBW) to the measured result, whereas RBW (<500 kHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.

d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add 10 log (1MHz/RBW) to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.

e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

11.3 Test Equipment List and Details

Descriptions	Manufacturers	Models	Serial Numbers	Calibration Date	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	FSEK30	825084/006	2016/12/15	2017/12/14
Attenuator	MINI-CIRCUITS	BW-S10W5+	N/A	2017/03/16	2018/03/15
Cable	WOKEN	SFL402	S02-160323-07	2017/02/22	2018/02/21

**** Statement of Traceability:*** BACL Corp. attests that all calibrations have been performed according to TAF requirements, traceable to the ETC.

11.4 Test Environmental Conditions

Temperature:	24° C
Relative Humidity:	58 %
ATM Pressure:	1010 hPa

The testing was performed by Andy Shih on 2017-09-08.

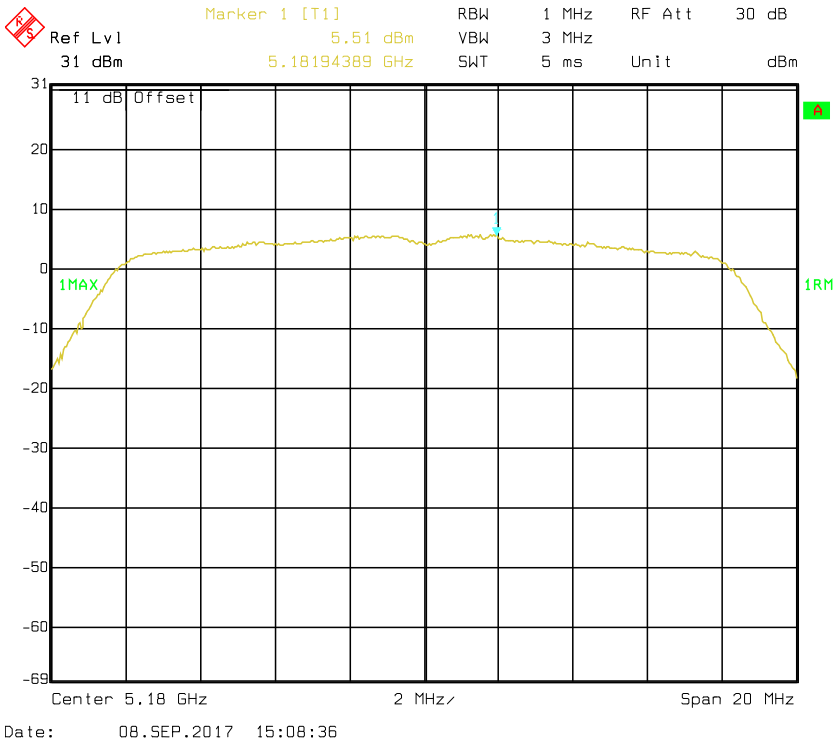
11.5 Test Results

Test Mode: Transmitting

Channel	Frequency (MHz)	Power Spectral Density (dBm/MHz)	Limit (dBm/MHz)	Result
802.11a Mode				
Low	5180	5.51	11	PASS
Mid	5200	5.86	11	PASS
High	5240	5.92	11	PASS

Please refer to the following plots

PSD, Low Channel



PSD, Middle Channel

PSD, High Channel

******* END OF REPORT *******